



Tennessee Valley Authority, Post Office Box 2000, Soddy Daisy, Tennessee 37384-2000

February 8, 2013

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: **Licensee Event Report 50-327 / 2012-001, "Unanalyzed Condition Affecting Essential Raw Cooling Water System due to External Flooding"**

The Tennessee Valley Authority is submitting this report in accordance with 10 CFR Part 50.73(a)(2)(ii)(B), for a condition that placed both units in an unanalyzed condition that significantly degraded plant safety; (a)(2)(v)(A), for a condition that could have prevented the fulfillment of the safety related function of Essential Raw Cooling Water (ERCW) system needed to shutdown the reactor and maintain it in a safe shutdown condition; and (a)(2)(v)(B), for a condition needed to remove residual heat from various components cooled by the ERCW system.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Mr. James Proffitt, Sequoyah Site Licensing Manager at (423) 843-6651.

Respectfully,

John T. Carlin
Site Vice President
Sequoyah Nuclear Plant

Enclosure: Licensee Event Report -
cc: Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

IE22
NRC

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JTJ: SKD

Enclosure

bcc (Enclosure):

NRC Project Manager – Sequoyah Nuclear Plant
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LICENSEE EVENT REPORT (LER)(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resources@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

Sequoyah Nuclear Plant (SQN) Unit 1

2. DOCKET NUMBER

05000327

3. PAGE

1 OF 9

4. TITLE:

Unanalyzed Condition Affecting Essential Raw Cooling Water System due to External Flooding

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	12	2012	2012	001	00	02	08	2013	SQN Unit 2	05000328

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

- | | | | |
|---|---|--|--|
| <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) |
| <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
| <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(ix)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) |
| <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) |
| <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) |
| <input type="checkbox"/> 20.2203(a)(2)(v) | <input type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input type="checkbox"/> OTHER |
| <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below
or in NRC Form 366A |

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

Jon Johnson, Program Manager

TELEPHONE NUMBER (Include Area Code)

(423) 843-8129

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On December 12, 2012, at approximately 1914 Eastern Standard Time, Sequoyah Nuclear Plant determined that Unit 1 and Unit 2 were at risk of external flooding inundating the Essential Raw Cooling Water (ERCW) Pumping Station through inadequate electrical conduit penetration seals entering the ERCW Pumping Station. This condition could allow flood waters to enter the ERCW Pumping Station at a rate greater than the installed sump pump capacity creating a condition that could result in the ERCW system being unavailable to perform its design function during a flood event above plant grade. No actual flooding condition occurred or currently exists. This condition has no impact on ERCW system operability during any non-flooding event.

The root cause evaluation determined that existing documentation including licensing documents and configuration controlled drawings for the ERCW Pumping Station do not contain sufficient information to identify the design basis flood barriers.

Compensatory measures are currently in place and permanent modification of inadequate conduit seals are scheduled for repair per design requirements.

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NARRATIVE

I. PLANT CONDITION(S)

At the time of the discovery of the condition, Tennessee Valley Authority (TVA), Sequoyah Nuclear Plant (SQN) Unit 1 was operating at approximately 100 percent rated thermal power (RTP) and SQN Unit 2 was shutdown (defueled).

II. DESCRIPTION OF EVENT

A. Event:

On December 12, 2012, SQN performed an inspection of electrical manway (MNWY) - 33 and confirmed that inadequate electrical conduit penetration seals (approximately elevation 686 feet) provided an in-leakage path into the Essential Raw Cooling Water (ERCW) [EIS Code KI] Pumping Station. The condition was previously evaluated as a degraded non-conforming condition, as determined by a Functional Evaluation (FE). It was previously considered based on review of the drawings for the MNWY 33 electrical conduit runs that the conduit penetrations were sealed. Since this was not the case, SQN concluded that the as-found condition was reportable because SQN was operating outside of the current licensing basis as a result of the ERCW Pumping Station not being able to remain dry during a flood event above plant grade (elevation 705.0 feet). The December 12, 2012 discovery date for 10 CFR 50.72 and 50.73 reporting is based on this recognition of the safety significance of the issue.

The condition did not result in any immediate structure, system, or component (SSC) inoperability. The Fukushima Dai-ichi Near-Term-Task-Force (NTTF) flooding walkdown efforts encompassed the extent of condition for identifying configurations that could bypass external flood protection features. The inadequate electrical conduit penetration seals have been identified and are scheduled for permanent repair.

On December 12, 2012, at 1914 Eastern Standard Time, NRC was notified, in accordance with 10 CFR Part 50.72(b)(3)(ii)(B), for a condition that places both units in an unanalyzed condition that significantly degrades plant safety and 50.72(b)(3)(v)(A), for a condition that could prevent the fulfillment of the safety related function of the ERCW system needed to shutdown the reactor.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

None

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C. Dates of Major Occurrences:

1971	The initial design criteria for electrical cables in the MNWYs penetrating into the ERCW Pumping Station included a testing requirement to fill the MNWYs with water and be pressurized. To perform the test, each of the MNWY covers needed to be watertight.
April 26, 1974	The 1971 design criterion for electrical cables leading to the ERCW Pumping Station was revised to remove the initial testing requirement. The revised design change stated the ERCW Pumping Station will remain dry during a flood but, did not identify flood barriers or provide details to maintain the ERCW Pumping Station dry.
January 24, 1978	As-Constructed drawings of ERCW Pumping Station were issued. However, the documentation neither provided clear information about ERCW Pumping Station design basis flood (DBF) boundaries nor provided reference that validated potential flood boundaries were adequate for a DBF. The documentation did show the original plant design had CHICO A, a leak sealing compound, in electrical conduits in MNWY-33 but, no analysis supports CHICO A as a suitable flood barrier.
October 10, 1980	A revision to the conduit and grounding drawings included a reference to generic fire penetration drawings for sealing instructions because of a similar detail for EYS sealing fittings with CHICO A compounds. As a result, a loss of configuration control occurred because the fire protection drawings contained sealing details that did not pertain to flood barriers.
January 15, 1985	A revision to fire protection drawings allowed for use of Dow Corning room temperature vulcanizing (RTV) compound as a substitute for CHICO A in fire stop penetrations. Limited testing of the Dow Corning RTV was performed in 1980 for a different application. There is no documentation supporting adherence to the vendor recommended application of Dow Corning RTV for MNWY-33.

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July 11, 1986	A revision to the fire protection drawings included a note to discuss watertight conduit and penetration seals. Testing performed using the Dow Corning RTV in blank electrical conduits was performed but, does not provide satisfactory results for use as a watertight seal (it leaked).
June 17, 1991	SQN implemented a design modification to remove the MNWY watertight cover and install dipstick holes to determine if the MNWY had flooded. Since no requirements for periodic leak testing were identified, and it was presumed that the watertight cover seals no longer performed a function, the MNWY cover seals were removed. This left the electrical conduit seals as the only barrier against a flood above plant grade.
July 7, 1995	A design modification for electrical conduits allowed the use of 'C' conduit with RTV in place of the EYS sealing fittings with RTV. The design modification did not contain sufficient detail for DBF considerations.
August 13, 2002	An administrative change to the conduit and grounding drawing denoted that EYS sealing fitting were not required and 'C' conduit could be substituted for electrical conduits.
September 16, 2012	The NTTF walkdown identified a potential leak path into the ERCW Pumping Station via electrical conduits.
November 15, 2012	An FE was conducted for the potential leak path into the ERCW Pumping Station via electrical conduits.
November 19, 2012	A temporary modification to install sump pumps into the ERCW Pumping Station is performed.
December 3, 2012	A design modification to insert conduit seals in MNWY-33 electrical conduits is developed for implementation.

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- December 12, 2012 The steel MNWY cover and concrete missile shield at MNWY-33 is removed for inspection and documentation of as found conditions. Upon inspection of MNWY-33, TVA determined that SQN Units 1 and 2 were at risk of flooding into the ERCW Pumping Station during a flood above plant grade as a result of electrical conduit penetration seals not being filled with material required to make the ERCW Pumping Station watertight. Subsequently, an 8 hour notification was made to the NRC.
- December 15, 2012 The temporary modification for the ERCW Pumping Station is revised to add larger capacity sump pumps based on a revision to the in-leakage calculation. The installation of the sump pumps was completed.
- January 4, 2013 The FE for potential leak path into the ERCW Pumping Station via electrical conduits is revised as a result of the as found inspection results.
- D. Other Systems or Secondary Functions Affected:
- No other systems or secondary functions were affected by this event.
- E. Method of Discovery:
- The condition of potential water in-leakage into the ERCW was identified by TVA during the NTTf walkdown.
- F. Operator Actions:
- Operations issued a Standing Order that provides guidance for operation of the ERCW temporary sump pumps upon meeting entry conditions for Abnormal Operating Procedure (AOP)-N.03, External Flooding.
- G. Safety System Responses:
- No safety systems activation occurred.

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III. CAUSE OF THE EVENT

A. Root Cause:

The root cause analysis determined that existing documentation including licensing documents and configuration controlled drawings for the ERCW Pumping Station do not contain sufficient information to identify flood barriers. SQN design criteria for Flood Protection, states that the ERCW Pumping Station shall remain dry, but does not clearly identify what is credited as flood barriers. Further, configuration controlled drawings do not indicate that the conduit and penetration seals are performing the function of a flood barrier, only that these are watertight.

B. Contributing Factor:

- Inadequate configuration control for DBF protection existed as noted by several revisions to configuration controlled drawings which led to an inadequate seal applied to conduits in MNWY-33.
- Maintenance practices related to flooding issues were not sensitive to the requirements for maintaining adequate flood barriers during a flooding event.

IV. ANALYSIS OF THE EVENT

The ERCW system is safety related and is designed to supply cooling water to various essential heat loads in both the primary and secondary portions of each unit. Provisions are made to ensure a continuous flow of cooling water to those systems and components necessary for plant safety during either normal operation or under accident conditions; including external flooding events. The ERCW system is designed to continue operation during the post-flood condition. The availability of water for the most demanding condition on the ERCW system is based on the following events occurring simultaneously: loss of offsite power, loss of downstream dam, loss of two diesel generator units serving the same power train, and a design basis earthquake.

The ERCW Pumping Station is designed to remain fully functional for floods up to the Probable Maximum Flood (PMF) including wind-wave run-up. The deck elevation (elevation 720 feet) is below the PMF plus wind wave run-up, but is protected from flooding by outside walls. The lower elevations of the ERCW Pumping Station are intended to be watertight. The lower floors of the ERCW Pumping Station are separated into three bays. One bay is for all of the B-train ERCW components. There are two bays for the A-train ERCW components, each has essentially one-half of the required ERCW components.

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Based on a review of the supporting documents, it was determined that the electrical conduit penetration seals were meant to be the flood barrier. However, there was no clear identification of the flood barriers and their requirements. The associated maintenance activities on the flood barriers were performed using the fire penetration drawing, which is what the conduit and grounding drawing referenced.

The EYS sealing fittings with CHICO A sealing compound were originally installed in MNWY-33 and they acted as the barrier against flooding, but the lack of documented design basis for flooding barriers since initial construction eventually led to the replacement of some of the EYS sealing fittings with a less than adequate seal. A plant modification will install electrical conduit seals that have been tested to withstand the head pressure that could be exerted during a flood.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Based on the above information, a potential for a reduction in the defense-in-depth to nuclear safety existed. As a result, this event could potentially have adversely affected the health and safety of plant personnel or the general public had an actual flooding event occurred. No flooding event occurred or is pending.

The ERCW Pumping Station is designed to remain fully functional for floods up to the DBF. AOP-N.03, External Flooding, provides the necessary actions to mitigate the effects on plant operations during probable maximum external flood conditions.

Interim measures installed temporary sump pumps in the ERCW Pumping Station to remove excess water in order to keep equipment operable during flooding conditions. The FE calculates both the leak rate into the ERCW Pumping Station and pumping capacity of the temporary sump pumps. The FE determined that one bay of ERCW systems would be inundated based on the existing seals. One of A-train bays (two bays exist) is required for safe shutdown during a DBF. For the time prior to the installation of the temporary pumps, there is no supporting evidence to conclude that the ERCW system could have performed its design function during a flood above plant grade.

In addition to level considerations, plant flood preparations will cope with the "fastest rising" flood which is the calculated flood that can exceed plant grade with the shortest prediction notice. Reservoir levels for large floods in the Tennessee Valley can be predicted well in advance.

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A minimum of 27 hours, divided into two stages, is provided for safe plant shutdown by use of this prediction capability. Stage I, a minimum of 10 hours long, will commence upon a prediction that flood-producing conditions might develop. Stage II, a minimum of 17 hours long, will commence on a confirmed estimate that conditions will provide a flood. This two-stage scheme is designed to prevent excessive economic loss in case a potential flood does not fully develop.

The estimated probability is less than $2.6E-3$ that a Stage I flood warning will be issued during the 40-year life of the plant. The estimated probability is less than $1.0E-3$ that shutdown will need to continue into Stage II during plant life. Deterministically, the risk of a maximum flooding event is low because of the low probability of a PMF, the ample warning time, the development of the event over an extended period of time, and the additional resources that would be available to perform mitigating actions.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

The steel MNWY cover was opened to assess conditions affecting the ERCW Pumping Station was performed. Temporary modification installed sump pumps in ERCW Pumping Station. Installation of qualified conduit seals is in progress.

B. Corrective Actions to Prevent Recurrence:

The following corrective actions to prevent recurrence were identified in the root cause analysis and are being tracked in accordance with the SQN Corrective Action Program.

1. SQN will issue a design basis document that will include, but not limited to, the following: identify SSC's which provide external flooding protection for the Emergency Diesel Generator Building and ERCW Pumping Station, ensure adequacy of identified barriers, design requirements / regulatory and licensing requirements, reference AOP-N.03, reference drawing series and test data, and develop an inspection program for flood barriers.
2. An exterior flood barrier drawing series will be issued to identify the exterior flood boundaries and contain seal details. Associated drawings will be revised as applicable.

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VII. ADDITIONAL INFORMATION

A. Failed Components:

None

B. Previous LERs on Similar Events:

A review of previous reportable events for the past three years did not identify any similar events.

C. Additional Information:

The corrective action document for this report is Problem Evaluation Report (PER) 655763 (Root Cause Evaluation).

D. Safety System Functional Failure:

The ERCW system would not have been available to perform its function.

E. Unplanned Scram with Complications:

This event did not result in an unplanned scram with complications.

VIII. COMMITMENTS

None